

TOP SECRET

31 January 1956

MEMORANDUM FOR THE RECORD

SUBJECT : Test Pilot Evaluation of the Angel

In an effort to give proper consideration and take final action on every adverse comment contained in the subject report I have underlined each adverse statement. Each comment has been extracted from the report and discussed separately.

During a meeting between Mr. Bissell, Mr. Johnson and myself on 14 December 1955 we reviewed the comments and made decisions regarding corrective action to be taken by Lockheed. The following are extracts of corrective actions recommended in the subject report, and our comments.

(1) Thrust decay noted at altitude (65,000).

Active progress has been made to correct thrust decay at altitude. Special meetings have been held between Lockheed, Pratt & Whitney and NACA regarding this problem. Improvements have been made by calibrating each fuel control to a specific set of standards. More experience will be required before this problem is fully corrected. The P-31 engine should be an improvement over the P-37.

(2) Pilot may experience take-off difficulties in crosswind conditions; this aggravated by tail-wheel steering and rudder ineffectiveness at low speeds. Recommendation: nose-wheel steering.

Nose-wheel steering is not practical from an increased weight and utilization point of view. Since the aircraft is limited to certain ground handling characteristics after landing, full utilization of nose-wheel steering cannot be economical. It is agreed that crosswind take-offs and landings are limited; therefore such conditions will have to be considered in the operational scheduling of the aircraft. Further, the special concept of operation of this vehicle does not justify the installation of nose-wheel steering commensurate with standard USAF aircraft requirements. Tail-wheel steering effectiveness has been improved.

(3) Visibility during initial climb is virtually nil because of exaggerated nose-up attitude.

No corrective action can be taken to improve visibility during initial climb without major modification to the aircraft. On the other hand, the steep climb attitude is for a relatively short period of time and will have to be coped with during the operational employment of this vehicle.

TOP SECRET

TOP SECRET

-2-

(4) At high altitude when flying into the sun the heat on face of pilot is very uncomfortable. Recommendation: curtains or sunshades be provided.

Although several colored plexiglasses and other curtains have been tried, a final configuration has not been determined. Lockheed will, after further study and testing, provide curtains satisfactory for the mission.

(5) Cockpit temperature inadequate while letting down. This may become a factor in a long glide over a considerable period of time with engine out. Very little heat is provided when engine is running at low rpm. Pilots may desire slower rate of descent by adding power in order to provide heat.

Drogue chute deployment at high altitude will improve rate of descent thus allowing the retention of heat for a satisfactory period of time. Slower descent with increased power will also improve this situation.

(6) Oil and smoke expelled through air-conditioning system unacceptable.

This item must be corrected. Lockheed will continue to investigate corrective measures. Improvement has been accomplished by closing off the windshield defroster and installing circulating fans.

(7) Dihedral effect is non-existent. Dynamic directional stability does not fall within 1815B spec. requirements.

Later reports indicate that although directional stability may not be within existing specs, it is not detrimental to the profile mission. As more experience is gained and if it proves to be a problem, consideration will be given to correcting the situation.

(8) Moderate amount of adverse yaw encountered but is readily controlled with rudder.

Adverse yaw has not been reported by other pilots. Corrective control is apparently good at cruise speed but marginal at low speeds.

(9) Aileron forces are atrocious.

Lockheed will investigate the possibility of reducing aileron forces. However, aileron forces at altitude appear to be about right. To date SAC operational pilots have not commented on aileron control forces. Final decision will be made after more long-range missions have been flown.

TOP SECRET

TOP SECRET

-3-

(10) Response to rudder is slow and rudder effectiveness is not acceptable. However, rudder is very seldom used.

Since the rudder is not used except for certain landing conditions, no action will be taken. Comments from other pilots have not indicated that this is a serious problem, especially when the operations are controlled so as to eliminate crosswind landing conditions. There appears to be sufficient rudder effectiveness for spin recovery since the aircraft has recovered from a three turn inadvertent spin.

(11) Rate of roll is low and decreases with speed increase. It is acceptable for the purpose for which the airplane was designed.

Low rate of roll was purposely designed into the aircraft since its maneuverability is limited. No action will be taken to improve or increase rate of roll.

(12) Airplane No. 341 with new stabilizer. At 0.82 Mach No. pilot experienced moderate amplitude rudder buffet with no warning whatsoever. Pilot prefers standard stabilizer installation over the modified one because of Mach No. warning indications.

The new stabilizer is undergoing complete investigation. To date this is a controversial subject and no unanimous opinion can be obtained from the various pilots now flying the aircraft. It has been determined that the new stabilizer increases critical Mach No. to approximately 0.86. However, longitudinal stability at high altitude may be affected. Positive action will be taken after more tests have been completed.

(13) Caution is necessary during descents as dive brake buffet tends to mask Mach buffet. In this respect dive brake effectiveness is low and should be increased by 200%. This is considered one of the main deficiencies of the airplane.

It is difficult to correct buffet conditions with drag brakes out and at the same time increase drag effect. The aircraft needs as much drag as possible under this condition and any reduction of buffet would further reduce the drag obtained from dive brakes. Further tests with drogue chutes will be accomplished with the hope of improving this characteristic. Meanwhile, descents will have to be made on instruments with close observation given to Mach No. indications.

TOP SECRET

-4-

(14) The aileron switch should be incorporated with the elevator switch in a 4-way control button. Both aileron and elevator trim speeds are far too slow and should be increased by at least 100%.

The present aileron and elevator switch installation has been approved by SAC pilots. A combination of these two controls in one switch will not allow the flexibility required under emergency conditions. No action will be taken to combine these two controls. With regard to trim speeds, there are controversial arguments between pilots. The present trim speeds, although slow, tend to protect rapid accelerations to the aircraft. Until more pilot experience is gained on the aircraft, this change will not be made.

(15) There is a fairly heavy trim change when actuating the gust control and the pilot must concentrate to maintain the same attitude when actuating the gust control.

Pilot experience should cope with this condition. No action will be taken to correct or improve this condition because of the major changes involved.

(16) There is a yawing oscillation of approximately 5 degrees during the stall that cannot be readily controlled by the rudder.

This condition will be further investigated. However, it has not been reported by other pilots. Here, again, the aircraft should not be stalled frequently. After further testing, if this condition aggravates or develops into spin entry conditions, it will have to be corrected.

(17) At the stall with 30 degrees flap there is a sudden right wing drop with a right yawing movement. Neither of these characteristics are controllable and the stalling characteristics or lack of warning is not acceptable.

The same comment applies here as to (16).

(18) The approach and landing of this airplane is the most difficult maneuver to perform. The airplane is unwilling to slow down to the proper approach speed and although flaps aid in reducing speed the flaps reduce aileron effectiveness approximately 70% and increase aileron force approximately 50%. The airplane is virtually impossible to spot land.

Landing characteristics will be slightly improved by incorporating the drag chute. This condition is recognized; however, through aggressive training and experience spot landing technique can be improved. This will be followed up during the training period.

~~TOP SECRET~~

-5-

(19) Stalling characteristics are incompatible with airplane longevity.

Stalling characteristics that proved incompatible with aircraft longevity will continue to be investigated. However, to date 175 landings have been made with only one landing accident.

(20) Low rudder and tail-wheel steering effectiveness dictate requirement for nose-wheel steering in order that the pilot may maintain directional control.

See (2) above.

(21) As pilot experience is gained the engine may be cut on final approach to reduce the long floating distance.

Not a recommended procedure. Drogue chute will help floating tendency. This procedure could be used in an emergency.

(22) This airplane could not be adapted to the role of an interceptor because of its limiting Mach No. and maneuvering restrictions.

Procurement of the interceptor vehicle has been cancelled by USAF. However, flight comparisons with a B-52 at a later date will probably be initiated.

RECOMMENDATIONS:

1. A much greater effective drag device be installed to decrease the letdown time from altitude and to permit steeper approach angles and shorter landing distances. This device will also delete the need of landing flaps.

It is impossible to instal spoilers on this aircraft. The drogue chutes should improve drag characteristics of the aircraft.

2. Nose-wheel steering be installed replacing the tail-wheel steering.

The operational concept of the vehicle does not require such flexibility and additional weight prevents this installation on this series of aircraft. See para. (2) above.

3. A Mach No. limit warning device be installed. This is especially necessary if the modifications made on #341 are to be incorporated on subsequent airplanes.

There is no Mach warning device in existence and it does not appear feasible for the Air Force to develop such an instrument. Mach limitations will have to be controlled by close observation of the Mach meter at all times.

~~TOP SECRET~~

-6-

4. Provide adequate stall warning in the approach configuration and improve the stalling characteristics.

If difficulty is encountered during the training program a stall warning in the approach configuration may be incorporated. Improvement in stalling characteristics will be followed by Lockheed.

5. Instal auto pilot so pilot may devote time to other duties.

The auto pilot has been installed and is working satisfactorily at present. All articles will eventually be equipped with auto pilots.

6. Instal sun shades.

Adequate sunshades will be installed in all aircraft.

7. Instal filters in airconditioning system to prevent oil and smoke from entering cockpit.

Positive action has been taken to correct oil and smoke entering the cockpit.

8. Reduce aileron forces by 200%.

No action at present; however, after further experience reduction in aileron forces may be considered.

9. Increase elevator trim speed by 100%.

No change will be made in elevator trim speed now. However, consideration will be given to increased trim speed if more pilot comments indicate that this is necessary.

10. Increase aileron trim speed 50%.

The same comment applies as No. 9, above.

11. Incorporate aileron trim switch with elevator switch as a single four-way switch.

See (14), page 4, above.

12. Increase rudder effectiveness for take-off and landing under crosswind conditions.

No action. Operations will govern the conditions under which the aircraft will take off and land.

~~TOP SECRET~~

-7-

13. Exchange the present oil pressure and temperature gauges with the instrument light and instrument panel lights for more ease of readability.

A complete instrument panel arrangement conference will be held between SAC, Lockheed, and Headquarters personnel. Final decisions on all instrument locations will be determined at that time.

14. Provide cover for periscope when not in use.

Action now being taken to provide cover for the periscope.

15. Reduce the flap and dive brake buffet by 100%.

See comments under (13), page 3 above.

16. Add mike button to left side of control wheel or relocate from throttle to left side of control wheel.

Lockheed will comply with this request.

17. Provide a better cover for the aft fuel tank empty warning light.

See 13, above.

18. Mark 150 kts. clean limit speed on airspeed indicator.

Lockheed will comply.

19. Instal large type sensitive "g" meter in place of small standard "g" meter.

Decisions will be made on this item during the cockpit instrument panel conference. See 13, above.

20. Improve automatic operation of heat control so pilot will not have to divert attention from other duties to continually operate heat control manually.

This will be accomplished by Lockheed.

21. Provide a more sensitive and accurate pressure ratio gauge.

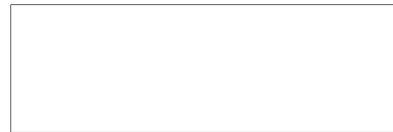
A more sensitive pressure ratio gauge is required. Continued improvement has been made and will be followed.

~~TOP SECRET~~

~~TOP SECRET~~

-8-

In summary, it is recognized that corrective actions directed by the Project Headquarters for each of the above comments have been limited. The principal reason for this has been to allow the aircraft to become operational under strictly controlled and specialized missions as soon as possible. While it is agreed that for a standard USAF aircraft, designed for multi-purpose utilization, many of the above recommended corrections probably should be made. It is reiterated, however, that this aircraft was designed and built under the concept of a single specialized mission. Many of the comments apply to a more varied utilization of the aircraft and has therefore been compared with USAF aircraft having all purpose characteristics. Major emphasis has been placed on reliability, comfort and stability and control of the aircraft at extremely high altitude in order to accomplish its basic photographic mission over enemy territory at the earliest possible date.



Colonel, USAF

25X1

~~TOP SECRET~~